Assessing the Ecological Condition of Wetlands on a Watershed Basis using a Rapid Method: The Cuyahoga River as a Case Study

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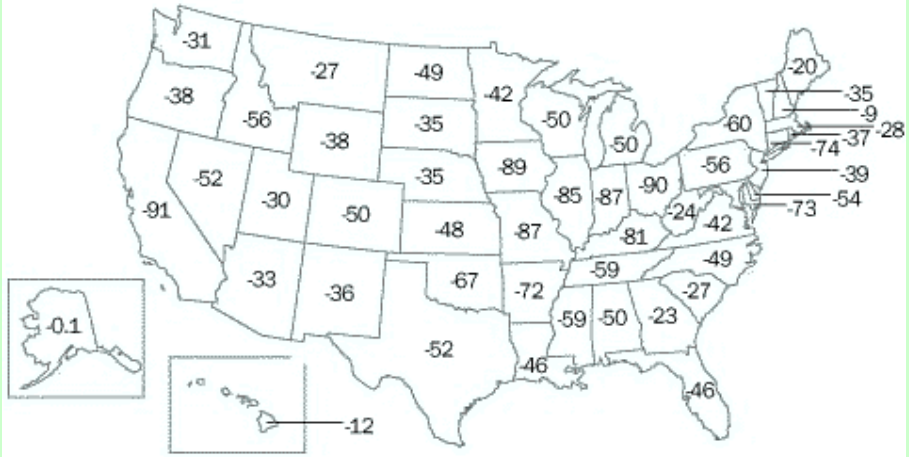
Wetlands in the US

- To date, nearly 55% of wetlands in the U.S. have disappeared (Dahl 1990)
- 90% loss in Ohio
- Results in loss of ecosystem services that wetlands provide

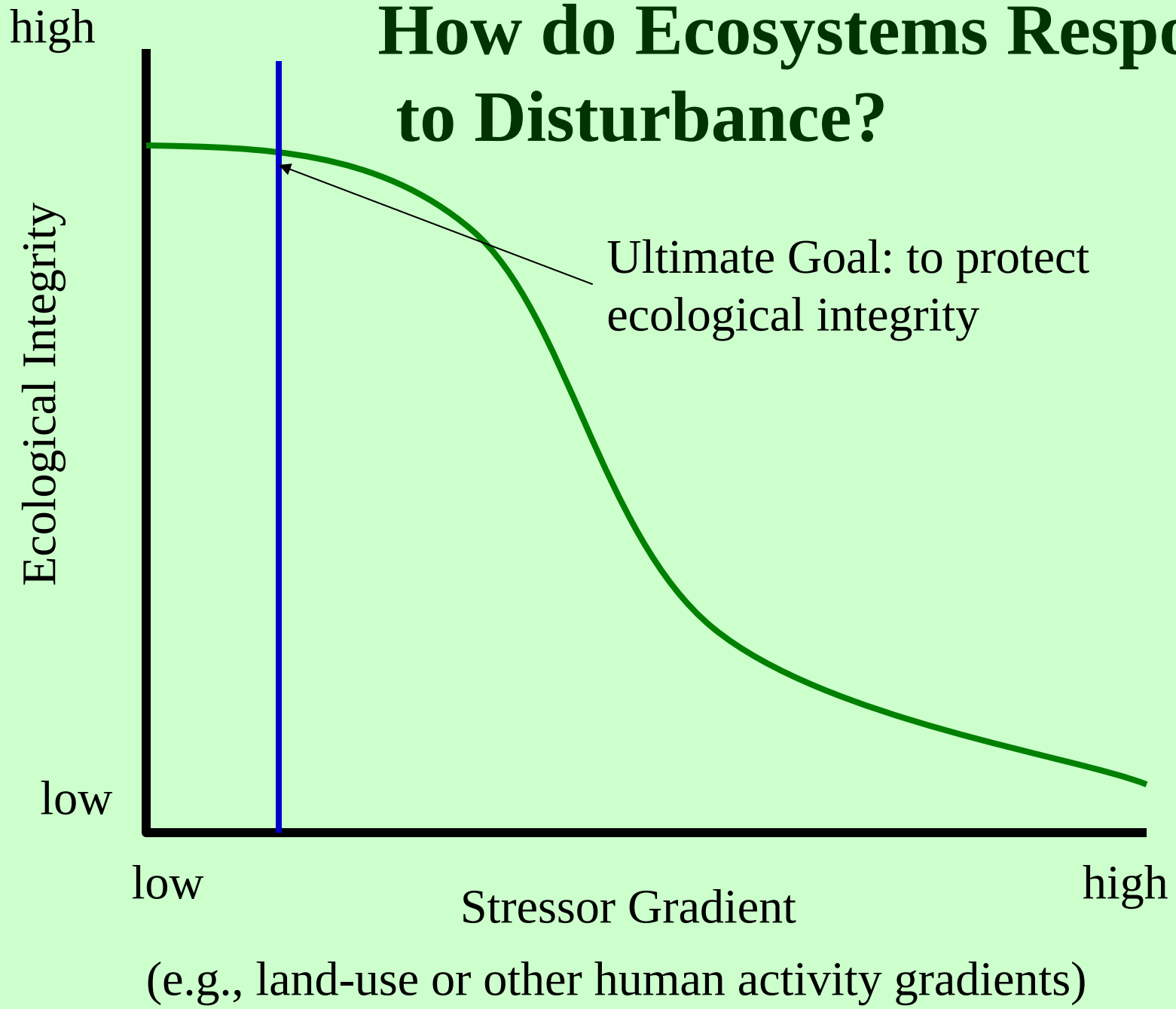
Percentage of Wetlands Acreage Lost, 1780's-1980's



Twenty-two states have lost at least 50 percent of their original wetlands. Seven states—Indiana, Illinois, Missouri, Kentucky, Iowa, California, and Ohio—have lost over 80 percent of their original wetlands. Since the 1970's, the most extensive losses of wetlands have been in Louisiana, Mississippi, Arkansas, Florida, South Carolina, and North Carolina.

Source: Mitch and Gosselink. Wetlands. 2nd Edition, Van Nostrand Reinhold, 1993

How do Ecosystems Respond to Disturbance?



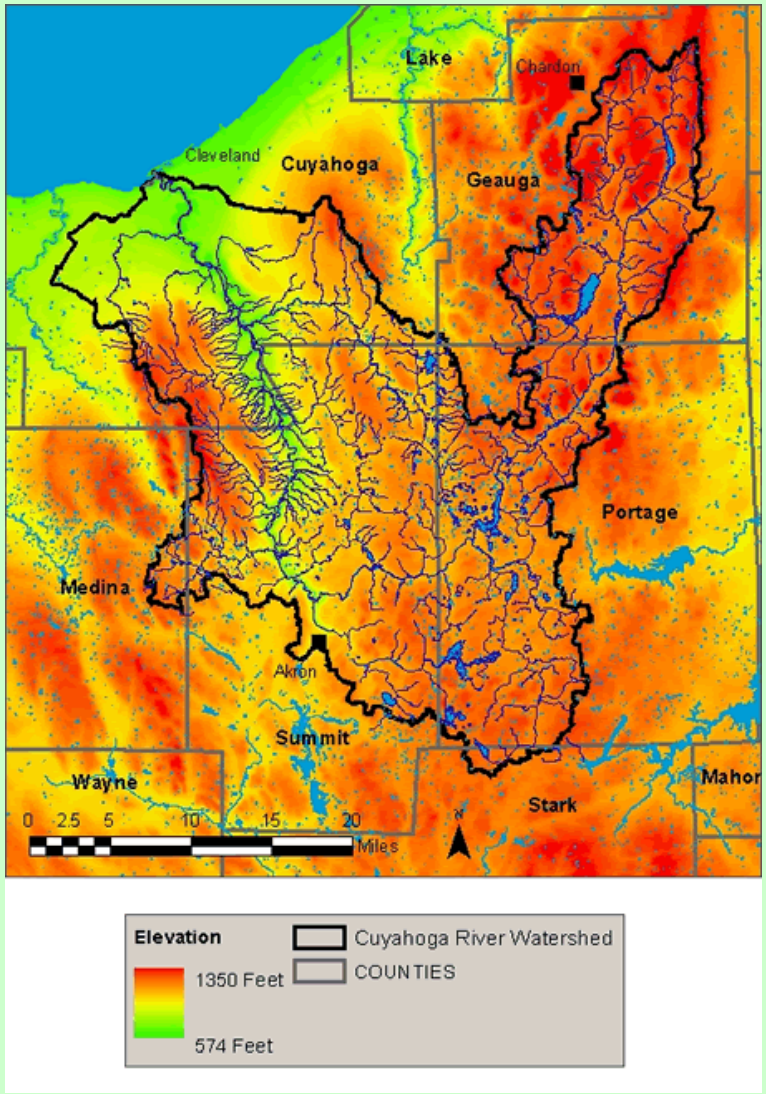
Tiered Assessment Methods

Level of Effort

Level of Detailed Information

- Comprehensive Assessment- level 3
  - Reference based
  - Data collection averages 4 hours for 4 people
  - *Index of Biotic Integrity*
- Rapid Assessment- level 2
  - Data collection averages 1-2 hours for 1-2 people
  - Calibrated to Comprehensive Assessment
  - Combines stressor and condition metrics
  - *Ohio Rapid Assessment Method*
- Landscape Assessment- level 1
  - GIS analysis
  - Calibrated with comprehensive assessment

Application on a watershed scale: the Cuyahoga River Basin

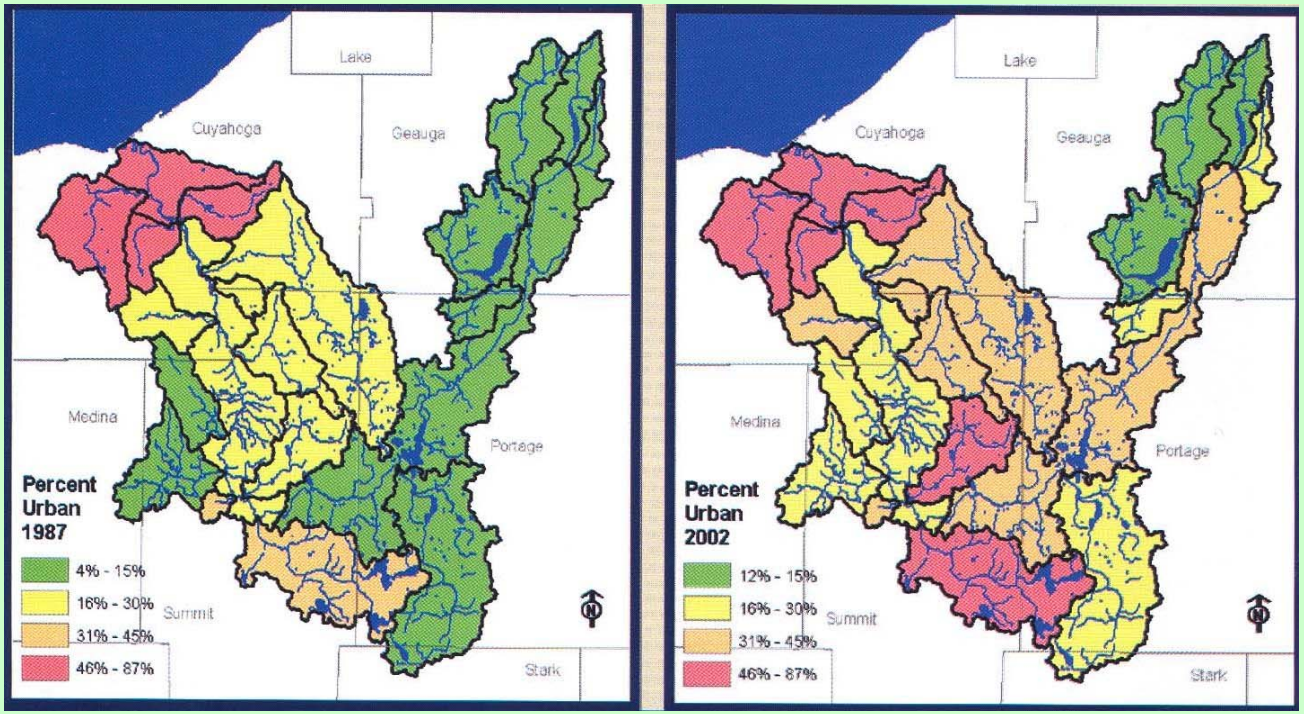


The Cuyahoga River Basin

- 815 square miles
- 3% of state land area, houses 16% of population
- Designated a Great Lakes *Area of Concern* due to legacy of industrial pollution

The Cuyahoga River fires: catalyst for environmental protection

Current Issues: urbanization



Courtesy Cuyahoga River RAP Committee

Study design: selecting sites for assessment

Define the sample frame

- Wetlands mapped by the Ohio Wetland Inventory
  - 5 classes

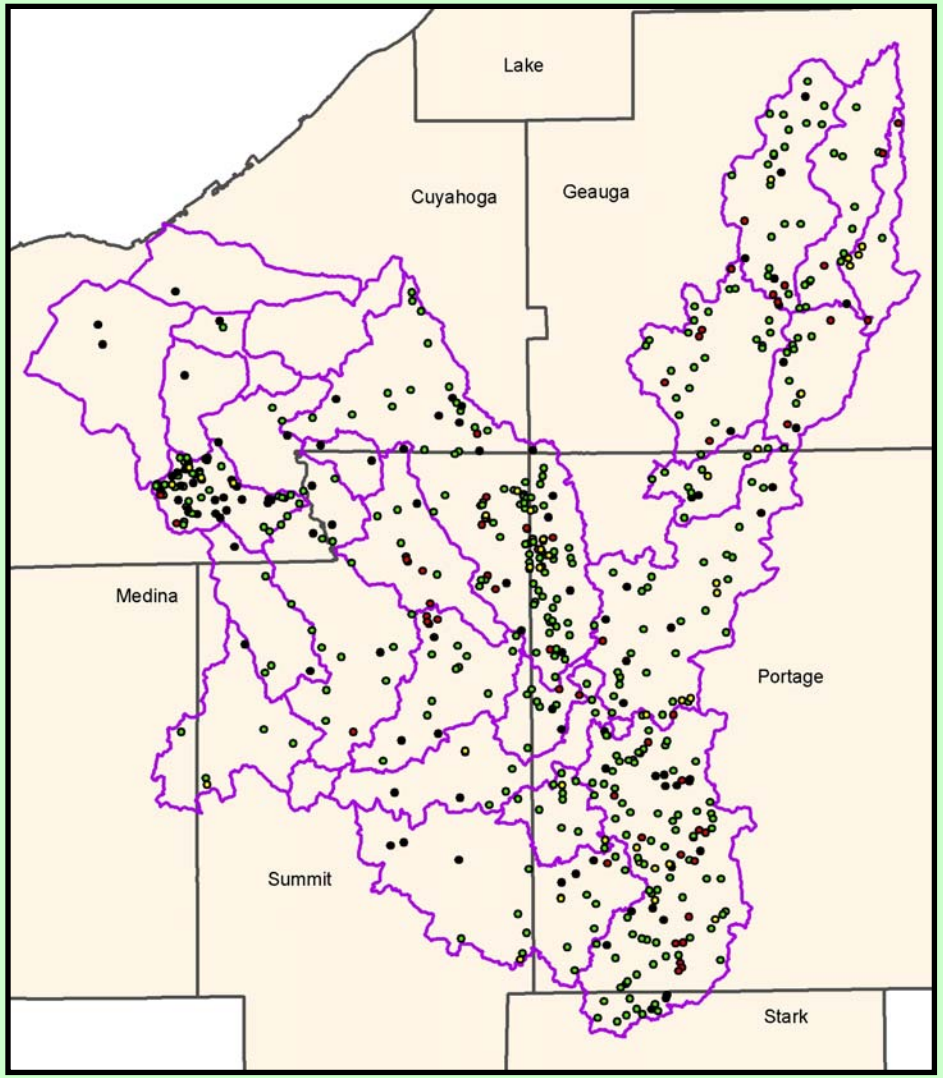
EMAP study design

- Sample points selected using “GRTS” design
- Provides a spatially balanced sample with ordered points

All 3 levels of assessment employed

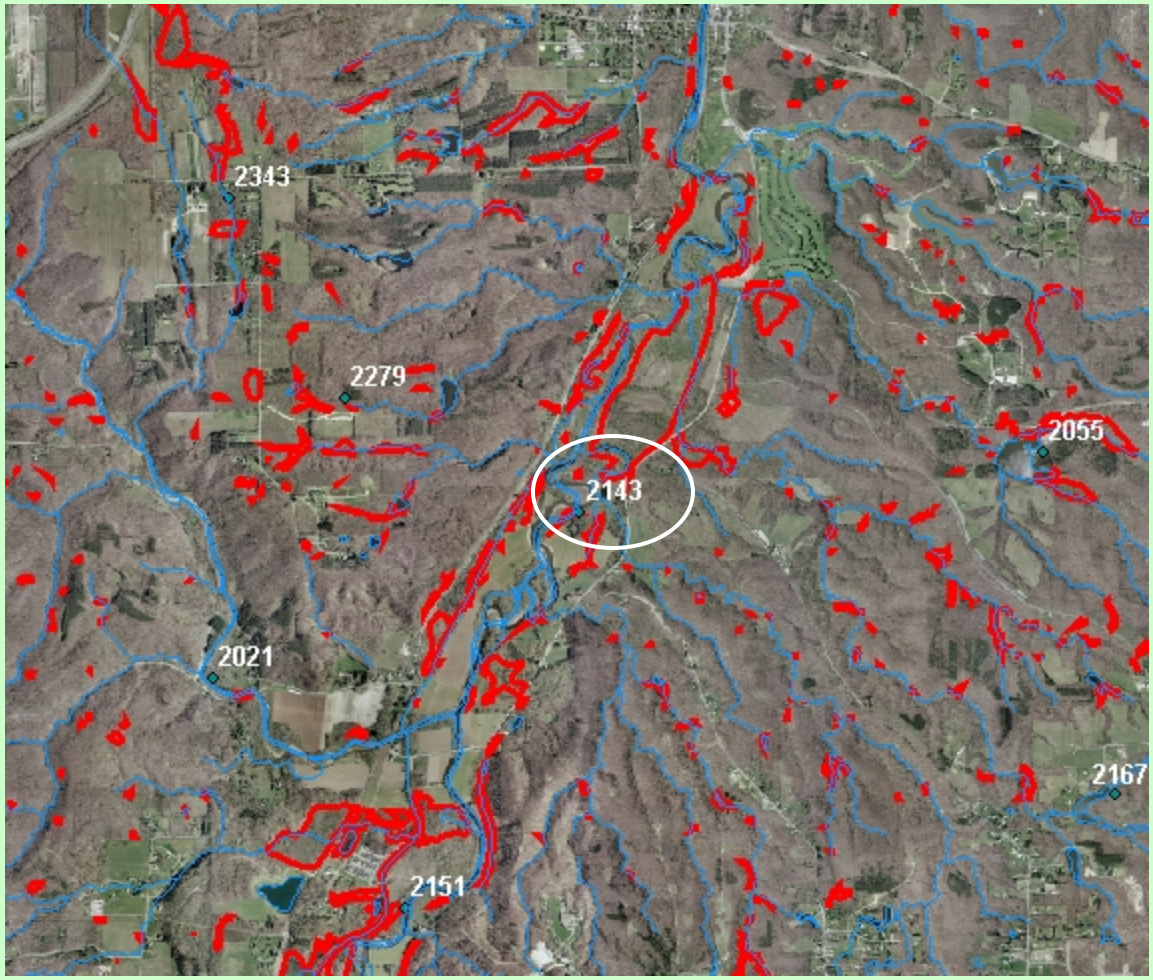
Randomized Sample Points

- 1600 points generated for whole watershed
- Goal to sample 200
- 366 sites sampled
- of these, 243 wetlands



Site Access and Sampling

- *what did we do?*

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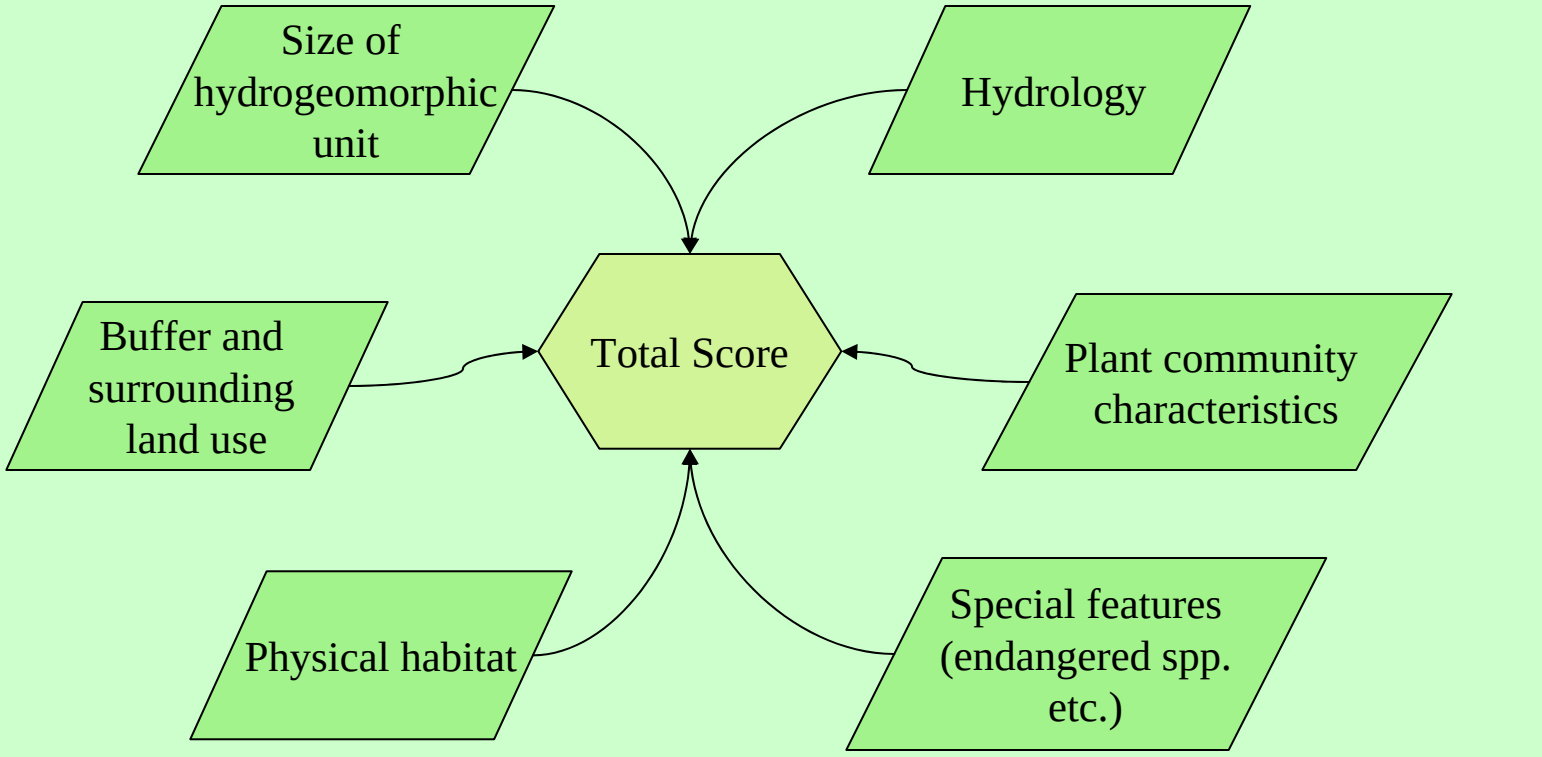
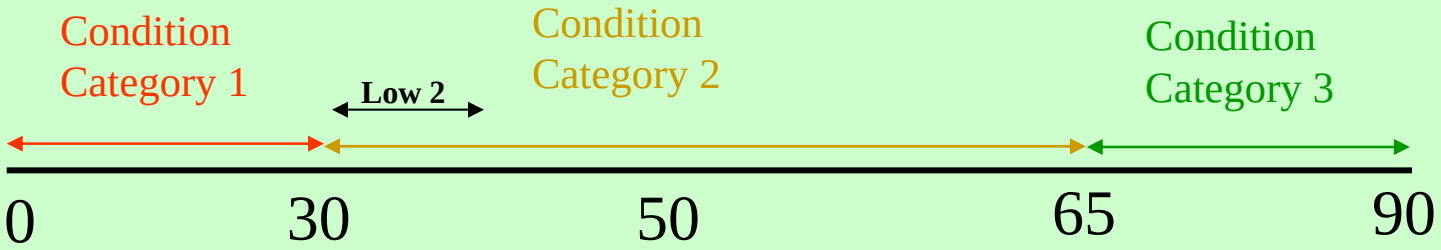
Overview of ORAM metrics



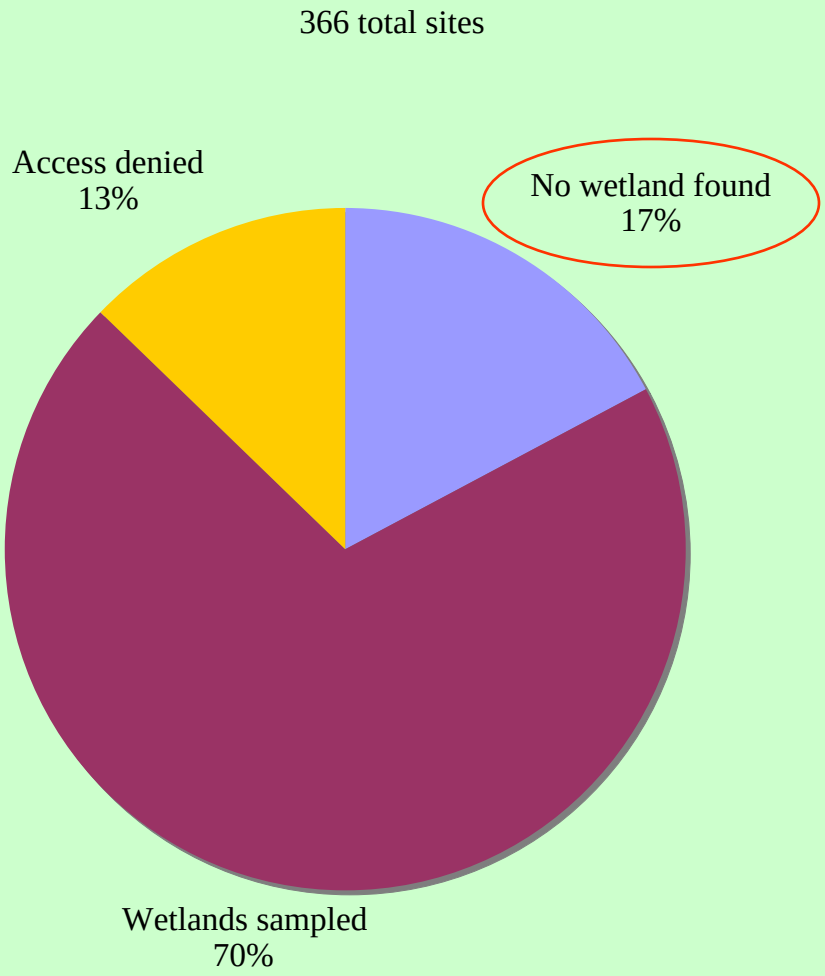


Comprehensive Sampling

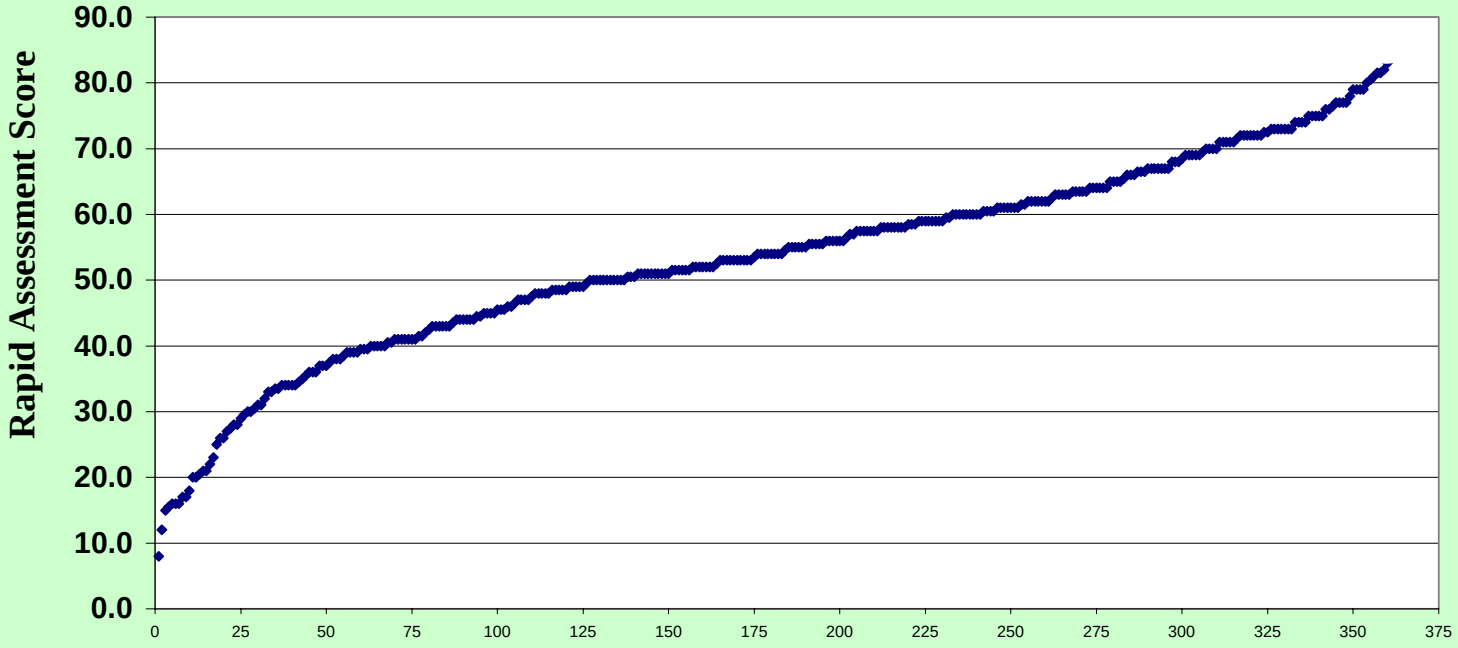
- At 10% of sites:
  - Vegetation IBI
  - Amphibian IBI
- At all sites:
  - Soils, standard chemical and enzymatic analysis

The site view…

Fate of sampled points

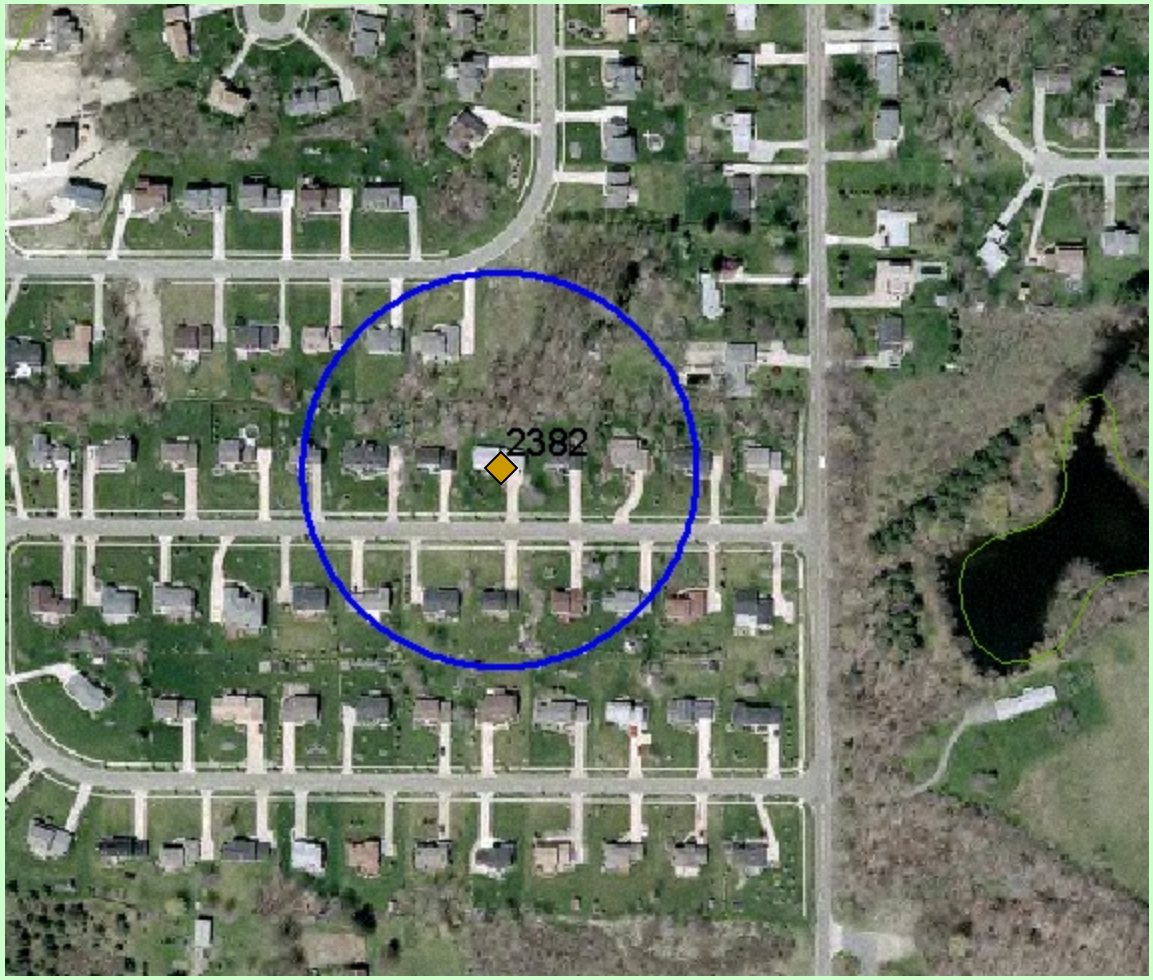


Preliminary Project Results

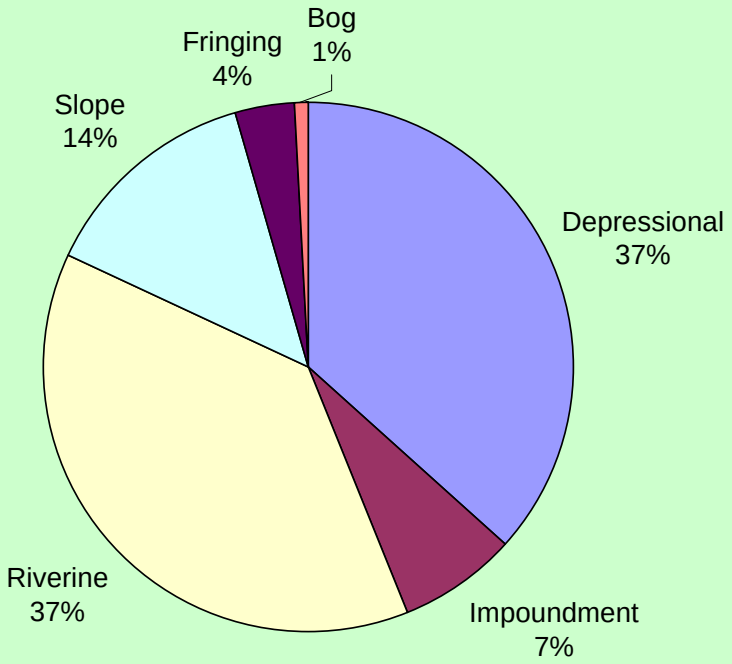


Ordered distribution of scores for all sites sampled

Urbanization and wetland conversion…



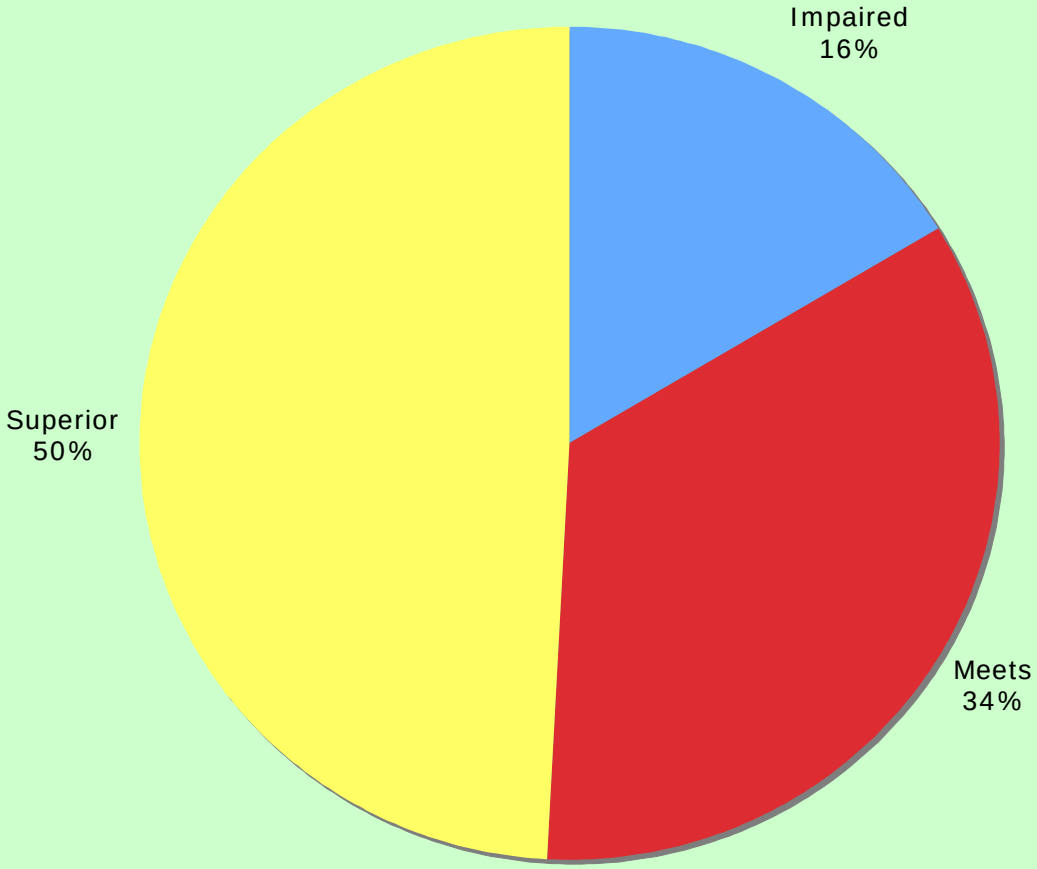
Diversity of wetland types



N = 243

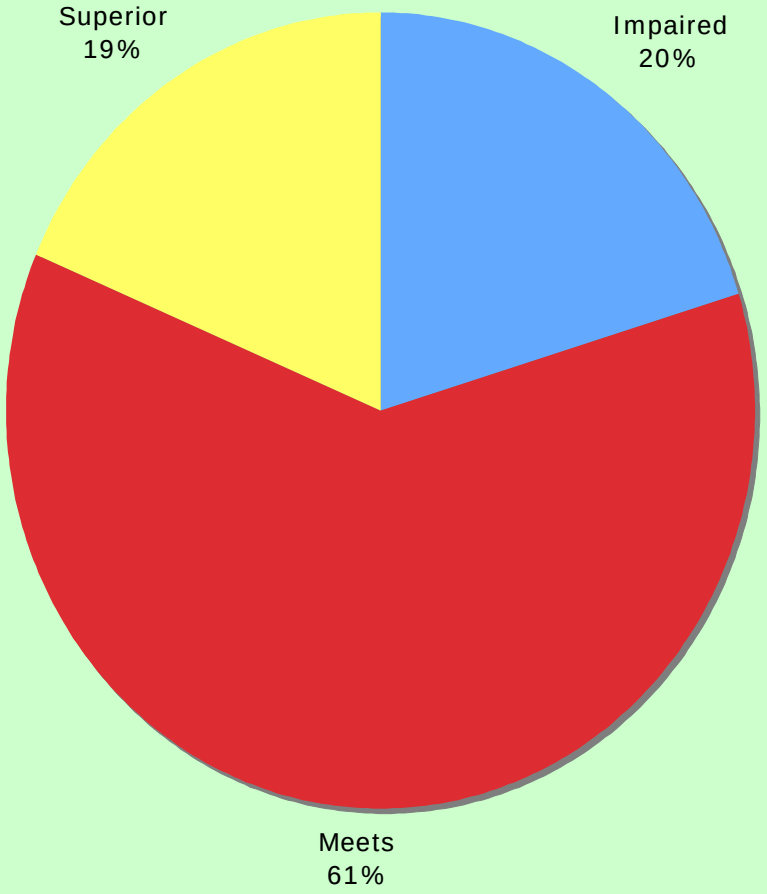
Geauga County Wetland condition

67 wetlands



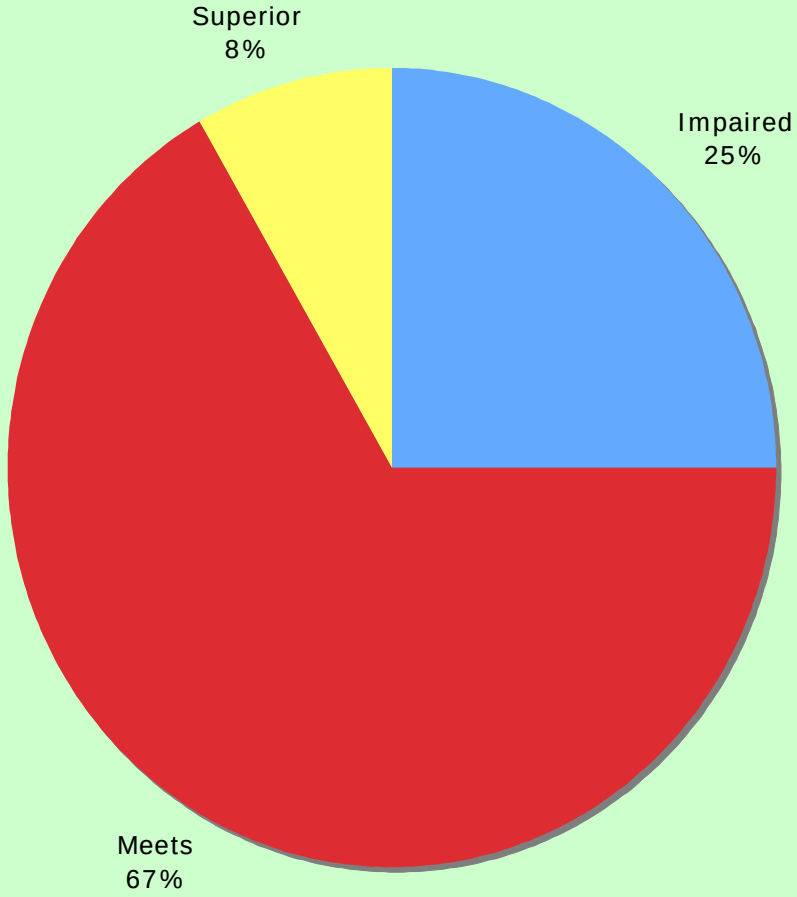
Portage & Stark Counties

108 wetlands

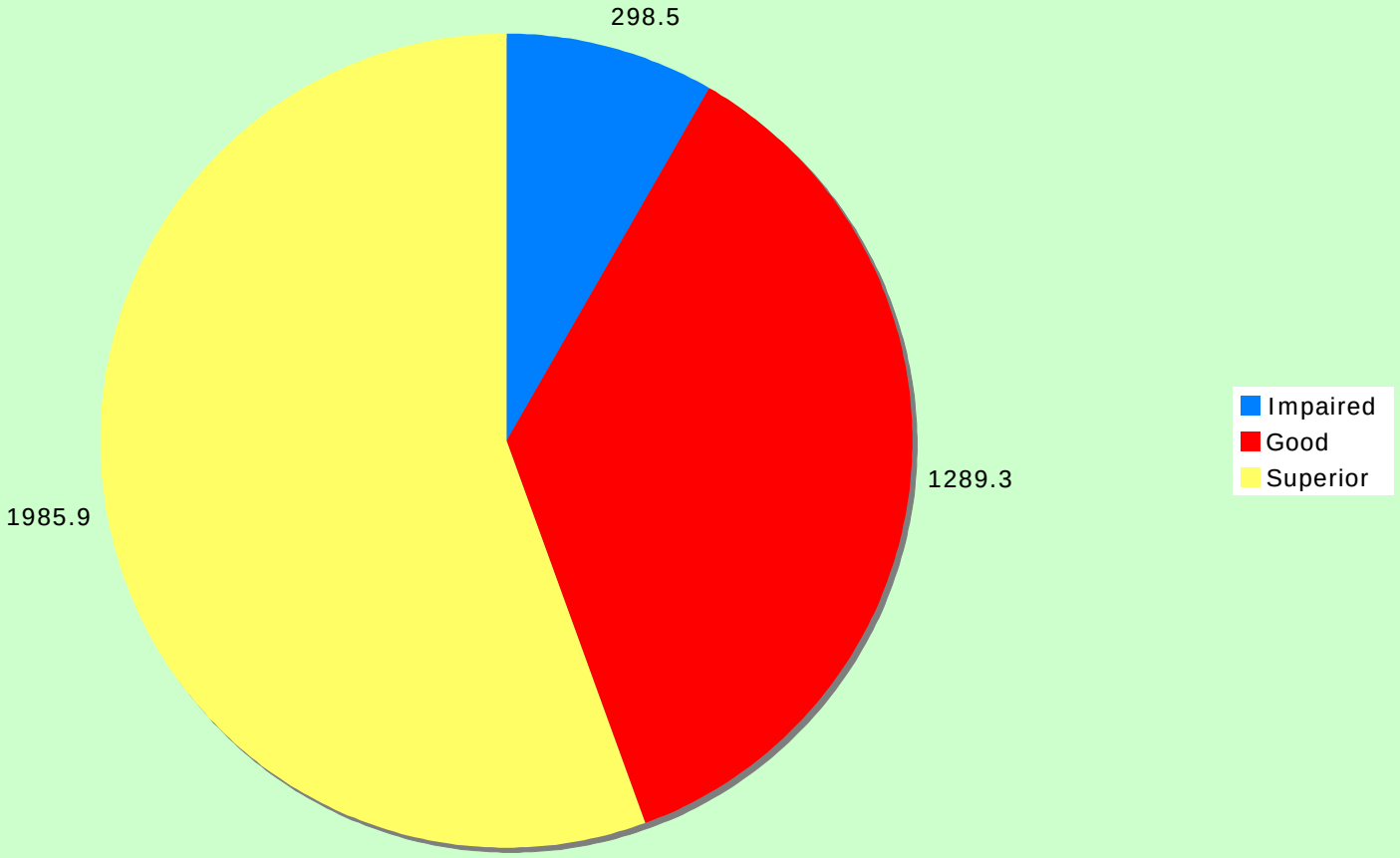


Cuyahoga and Medina Counties

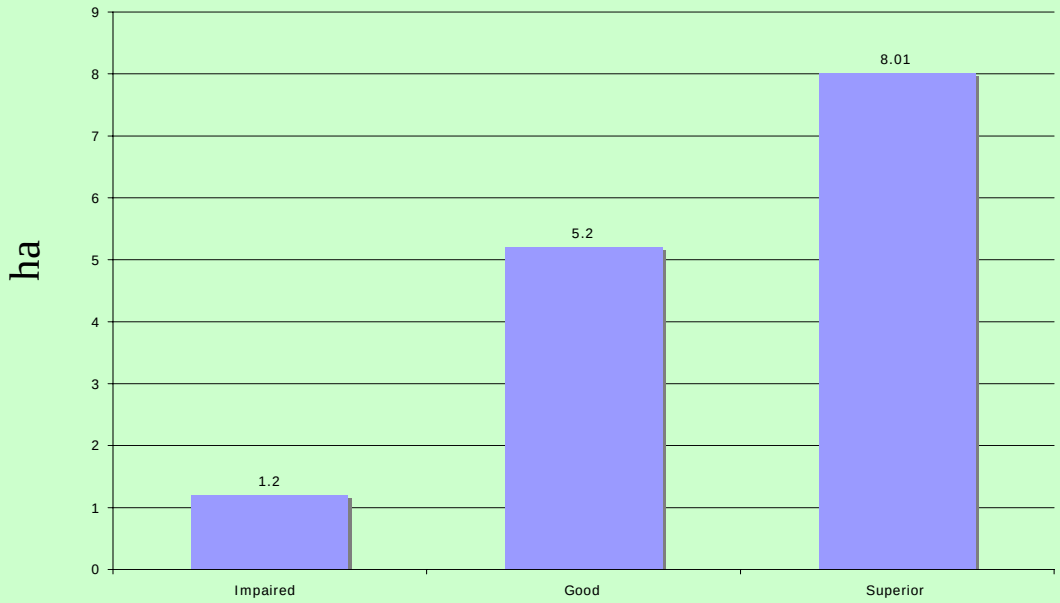
12 wetlands



Total acres per condition category

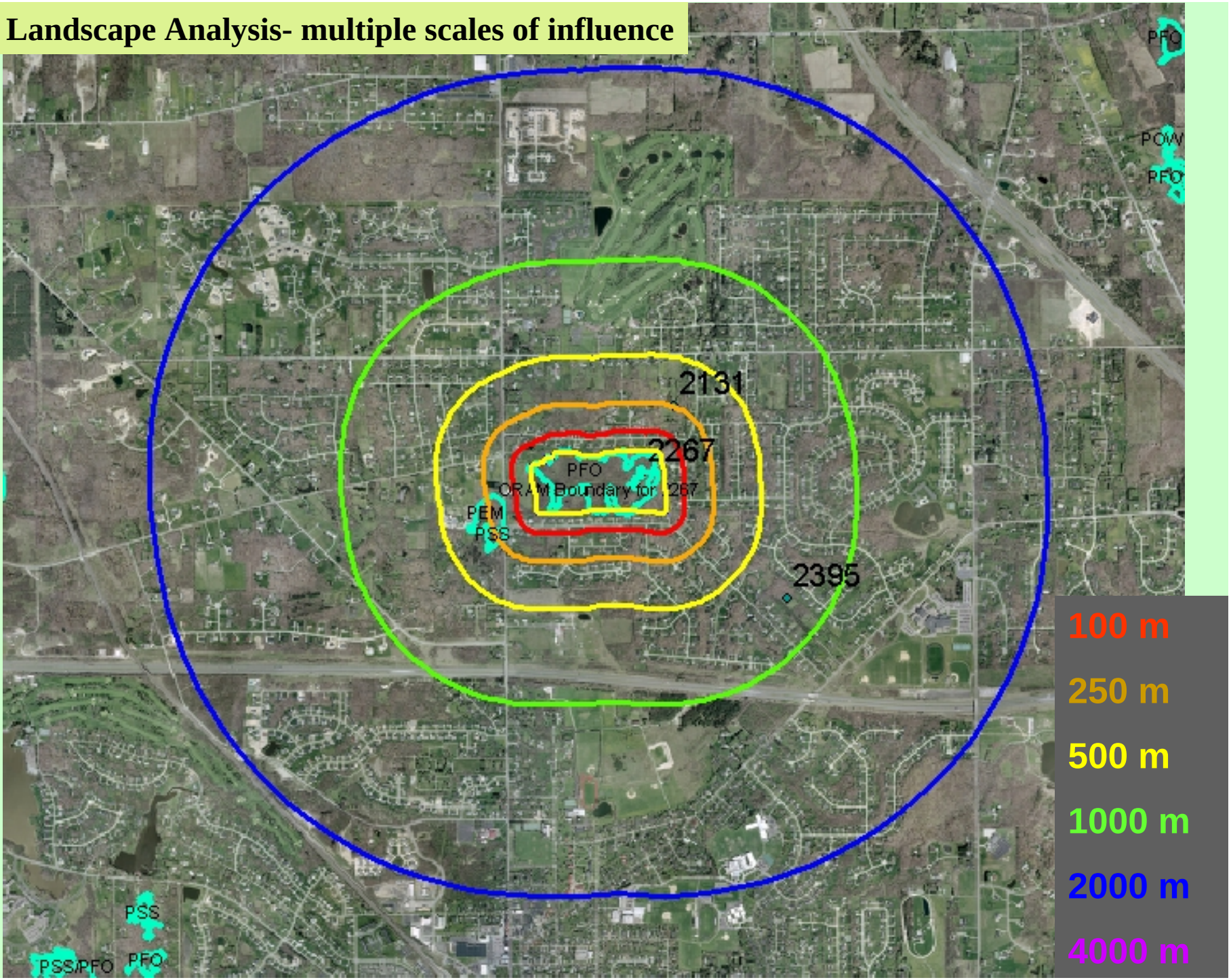


Mean wetland size per condition category



Wetland condition categories

Landscape Analysis- multiple scales of influence



Landscape Development Index (LDI)

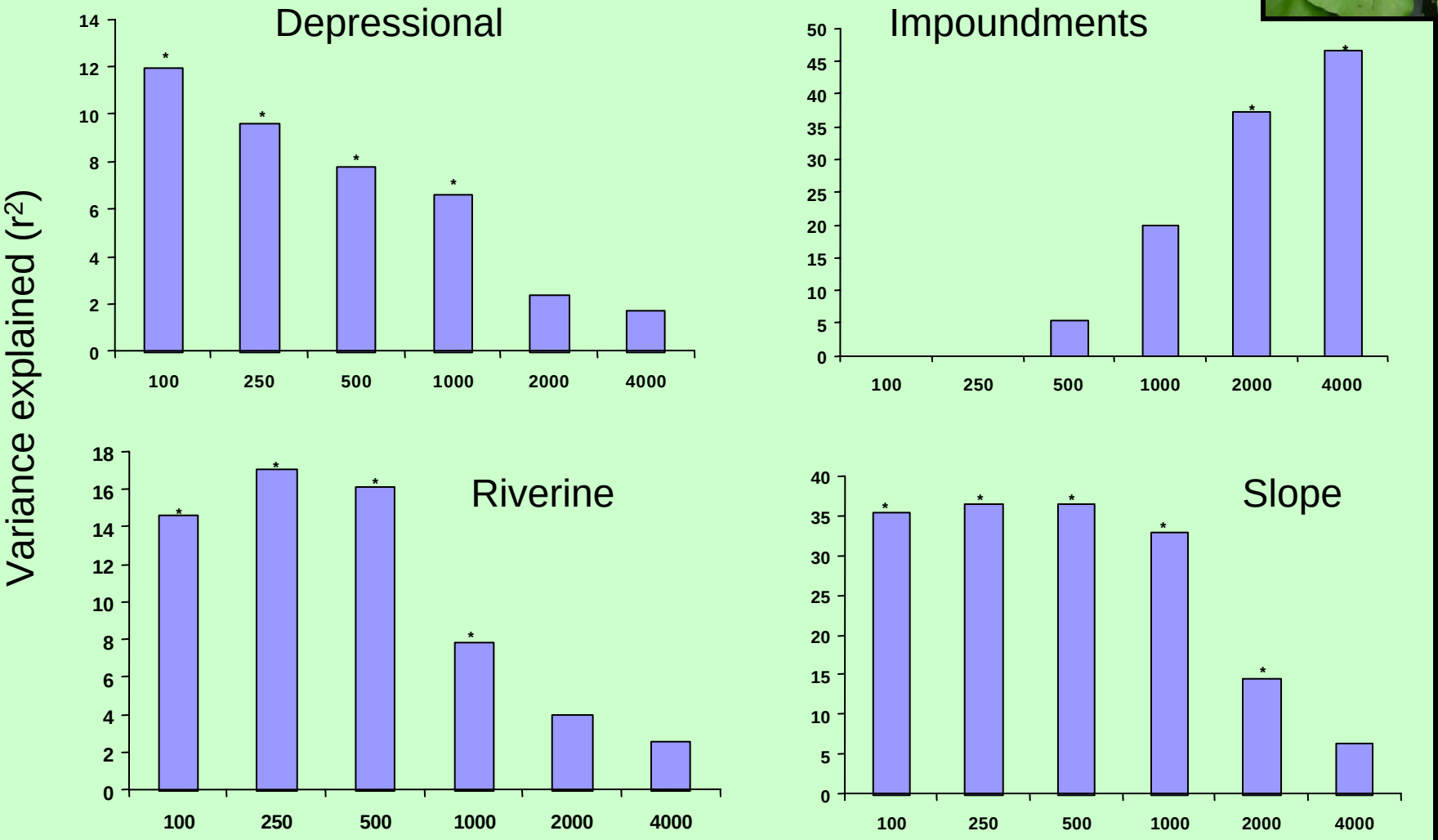
$$LDI = \Sigma \ (\%LU_i * LDI_i)*100$$

where $\%LU_i$ = percent of area under land use *i*
and LDI_i = LDI coefficient for land use *i*

LDI coefficients

Natural areas = 0
Row Crops = 3.25
Suburban = 4.04
Pasture = 1.08
Urban = 4.65

Variance explained in ORAM scores by LDI scores.



Diemeke et al. in prep

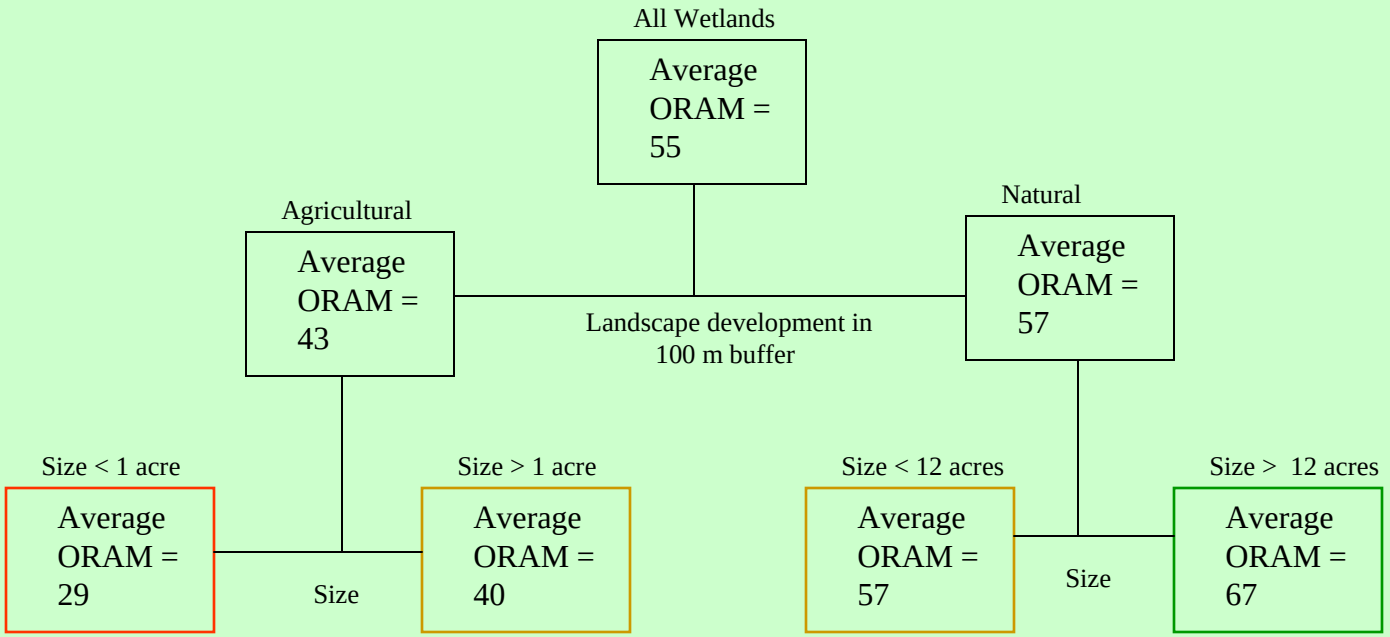
Nutrient Retention in Watershed

The annual P load to Lake Erie is 17,500 t, the TP held in 198 wetlands sampled account for 10% of this annual load

	Total Population sampled
Area	**1180 Ha**
TP	**1,500 t**
TN	**8,090 t**
TC	**114,000 t**
P-sorption Capacity	**101,000 t**

The P-sorption ***capacity*** of wetlands sampled accounts for 5 times the annual load of P to Lake Erie

In sum: what factors most affect wetland condition?



Diemeke et al. in prep

Conclusions

- Historically, our preoccupation with the ***quantity*** of wetlands has led us to overlook a loss of ***quality***
- Preservation and restoration efforts require information on current environmental condition
- Preservation and restoration must take into account the landscape setting of the wetland

Thanks to so many people!

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